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## Blended Course with Flipped Classroom Approach

### *Experiences*

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## BLENDING COURSE WITH FLIPPED CLASSROOM APPROACH: EXPERIENCES

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**Abstract:** This paper presents and analyses design decisions and development process of producing teaching materials for a blended course with flipped classroom approach at bachelor level at Aalborg University in Copenhagen, Denmark. Our experiences, as well as students' reactions and opinions will be described and discussed.

**Keywords:** E-Learning, open courseware, MOOC, blended course, flipped classroom

### 1. INTRODUCTION

The idea implemented in this paper is more than a decade old, and originates from Massachusetts Institute of Technology (MIT). In 1999, MIT Faculty considered how to use the Internet in pursuit of MIT's mission—to advance knowledge and educate students—and in 2000 proposed Open Courseware (OCW) [1]. MIT published the first proof-of-concept site in 2002, containing 50 courses. By November 2007, OCW completed the initial publication of virtually the entire MIT curriculum, over 1,800 courses in 33 academic disciplines. The report for 2014. says that:

- 2250 courses are published
- 1 billion page views and 170 million visits occurred.
- 100 courses have complete video lectures.
- 900 older versions of courses have been updated.

The next evolutionary step in Open Courseware development are Massive Open Online Courses (MOOCs), and one of the platforms that offers them is edX. The Massachusetts Institute of Technology and Harvard University created edX in May 2012. More than 70 schools, non-profit organizations, and corporations collaborate on the project. As October 2014, edX has more than 4 million students taking more than 500 courses online [2]. It hosts online university-level courses in a wide range of disciplines to a worldwide student body, including some courses at no charge. It also conducts research into learning based on how people use its platform. EdX differs from other MOOC providers, such as Coursera and Udacity, in that it is a nonprofit organization and runs on open-source software [2].

Another provider of MOOCs is Coursera [3], for-profit educational institution founded in 2012. by two Stanford professors, with a mission to offer massive open online courses (MOOCs) for everybody for free, but to charge a tuition fee for verified certificates. As of May, 2015,

Coursera had more than 1000 courses from 119 institutions and 13 million users from 190 countries [4].

Another “personalized learning resource for all ages” is Khan Academy [5], which offers practice exercises, instructional videos, and a personalized learning dashboard that empower learners to study at their own pace in and outside of the classroom, from elementary school level to university.

Europe also has its Open Courseware/MOOCs portal [6], which offers courses in many languages and will soon celebrate the second anniversary. There are also many other providers of different kinds of on-line educational materials worldwide. As the students are exposed and often quite confused with these abundant quantities of information on the web, an important question needs to be answered: in nowadays world, with so many different education materials publicly available, lots of them of a very high quality, what is an optimal way to present knowledge to students of some university of this world? With time being the most precious resource, and curriculum as a starting point, how can an individual university professor plan his/her teaching? Young people enrolled in the course are exposed, and used to high-quality digital materials (unfortunately quite often just movies and computer games), so sometimes it looks like they are expecting the same digital level of presentation in their courses too.

What is described in this paper is an experiment made in spring 2015 at Aalborg University Copenhagen. We have provided students with a selection of different on-line materials, some of them from the web, and some videos custom-made in the house. We have required that they study the available material before the class, and in the class only discussions and exercises were performed, following the flipped-classroom model. The course team consisted of six persons, two teachers, two observers (four

authors of this paper), and two student-helpers, who were technical support in filming and editing video-materials.

## 2. GETTING INSPIRATION

Authors of this paper have followed several Open Courseware and MOOC courses over several previous years both out of private hobby interest (biology!), and for a professional interest in technology-enhanced teaching and learning. During a course of time, it was interesting to follow evolution of courses from MIT OCW platform into edX format. A typical Open Courseware course (like, for example, [7]), consists of Syllabus, Calendar, Readings, Recitations, Assignments, Exams, Study Materials, and Video Lectures. If video lectures were included at all, at the beginning those were literally what the name said: video-captured actual lectures from an auditorium, occasionally including even late students passing in front of the camera. Although it is comforting to see that even elite universities have issues with the students being late for classes; and although vast majority of filmed professors are excellent public speakers, watching 45 minutes long videos, even if you are interested in the topic, showed not to be particularly engaging. Somehow the magic of being present in the class and listening to somebody sharing knowledge is lost in video-transmission.

The first major intervention observed was that the lectures were cut into 10-15 minutes chunks, with captions that describe the essence of the presentation in the chunk. Even this small intervention made a huge difference. The next step was to introduce a short question or two, most often in a multiple-choice format, between consecutive videos. The questions check the memory, and sometimes understanding, of the core point of the chunk.

One of the most frequently mentioned positive sides of video-lectures by students is a possibility to stop the video and repeat difficult parts as many times as you wish. This might sound straightforward in theory, but doing so in practice is not that easy, if the only available digital material is a classical movie-clip (sometimes also with subtitles in the same or different language). Lots of trial/error time is lost in rewinding and listening to repetitions of irrelevant stuff. The best solution we are aware of can be now found in edX courses, example of which is [8]. Evolution in digital style of presentations is visible if you compare very similar course from 2004 [7], and this one. As can be seen in Figure 1, the trick is to synchronize video and captions, each of them presented in their own window. Highlighted text is the one just being spoken. The user has an option to stop and move forward/backward in any of the windows, and content in both windows gets automatically synchronized.

Although this might not sound as much, it makes enormous difference in learning. When a student realizes that he has lost the track of presentation, either because something is not heard or understood well, pausing the video and reading the text that just precedes and follows the problematic spot is usually not only faster, but significantly more clarifying than re-listening same message over and over. This is when the combination of

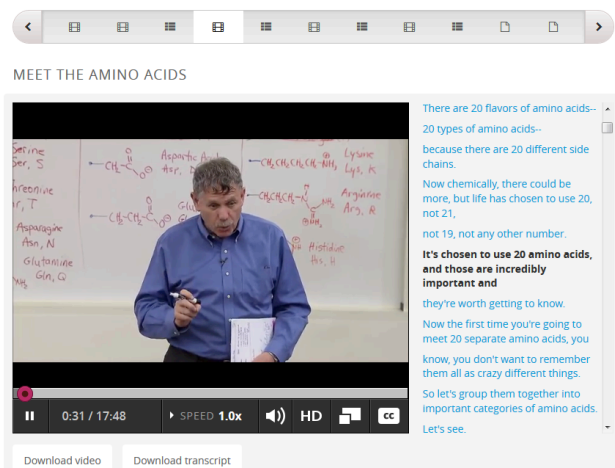


Figure 1. edX linked video/transcript [7]

existing technologies yields for novel and significantly improved experience.

However, although aware of this feature, we were not able to reproduce it in our materials, because the software which enables it is a proprietary one.

## 3. FLIPPED CLASSROOM IN A NUTSHELL

Flipped classroom approach, as a form of active learning, when class material, including recorded video presentation made by course teacher, is posted on-line before the class, and the class time is used on exercises and discussions, is gaining more and more attention [11] - [22]. We do have some positive experience using a flipped classroom approach as parts of previous courses [13], but this time we wanted to try flipping the whole course, using on-line material, and investigate students reactions. Trying the approach on a smaller scale, we are also very well aware of the difficulties connected with it. There is a huge amount of work needed to plan a full course with a new pedagogical approach, to produce (or find) appropriate videos etc., in to be able to “flip” the existing order of lecturing and giving exercises for homework as well as establish a new learning culture. Issues with the flipped classroom approach could be summarized as [17]:

Issues with flipped classroom:

1. Finding appropriate video material on-line takes time – and it is unrealistic to expect that it is possible to find something for free for the particular course
2. huge amount of work, knowledge and skills needed to create good learning materials that the students should study before the class
3. student inertia with existing methods of teaching/learning and
4. lack of novel pedagogy knowledge needed to “flip” the existing order of lecturing
5. developing methods to check whether students are coming prepared to the class (“class intro test” – automatic feedback to the teacher how many solved the simple exercise)

6. finding optimal exercises for work during the class and provoking discussion in the new classroom setup

The course on the 4<sup>th</sup> semester of Media Technology studies “Design and Analysis of Experiments” was chosen for this experiment. It was a good choice because the course is a blend of theories from the theory of science, applied psychology and statistics – so there are many different concepts which require different strategies to teach & learn.

The pilot project was planned run over a period of 3 years, allowing for developing, testing, and refining learning materials and pedagogical approaches as well as starting new pilots within other courses.

Together with the course teacher and teaching assistants, who will be engaged for this course, the pilot project requires extra resources to help with the technical side of developing learning materials. The initial project plan was:

- December/January 2015: Planning and producing materials for 12 lessons
- February 2015: start of the pilot project course: Design and analysis of experiments. Evaluation during the process.
- June 2015 first results – written report
- Fall 2015 Refining the course for 2016
- Written report for the second year

The course strategy, the students learning results and the course material will be tested and evaluated during the process by the teachers and a pedagogical expert. Evidence based results will be produced in reports.

What will be presented here are the results of the first year of the pilot project.

#### **4. TEACHERS EVALUATION OF THE PREPARED MATERIAL AND PROCESS**

After filming and editing of all needed videos and presenting the whole course on Moodle platform [10], which is a standard platform used on Aalborg University, teachers were interviewed on their experiences and observations. The answers based on personal experience mostly support findings from literature, and could be summarized as:

##### **1. Time requirements of the new approach**

Creating a good video requires a lot of work, much more than just doing the lecture, not only due to the technology involved (camera, sound recording) but also due to the necessity to adapt the presentation to video as a media.

##### **2. Experiences / thoughts / considerations on preparing the videos: A lot of aspects have to be considered to create a good teaching video:**

###### **a) Setup:**

a. It needs quite some time to setup the camera(s) in order to optimize lighting, angles, and shots.

b) A video is a different media than a live lecture in front of the students

a. Technical filming issues come into play: perspective, shooting frame, voice.

b. The content should be more concise, less repetitive, since the student can determine how many times she/he needs to watch parts of the video.

###### **c) Presentation**

a. Like in a lecture, the pronunciation, articulation, rhythm should be as clear as possible, maximizing intelligibility.

b. The video should contain a surplus compared to the slides, otherwise the slides would be enough. Therefore it is important that the presenter himself conveys an experience through the media. In a way the lecturer is required to have actor's capabilities of sharing experiences with the audience.

c. The presence of the presenter is important to attract the attention/excitement/interest of the viewer to the subject/line of thoughts. The ideal case would be an entirely free speech with all the content memorized by heart and no need to check any notes. This requires excessive rehearsing.

d. If the lecture is not entirely memorized, checking supporting notes is a critical issue. A possibility is to project the notes just behind the camera so the presenter's view direction does not deviate much from the camera direction. This could be possible in some AAU rooms with projectors mounted in two opposite directions. However here it needs to be technical feasible to project on both screens at the same time. If this is not possible, the notes should be positioned near the direction of the camera.

e. The “studio effect” rises a problem. Whereas in a live lecture setting the attentive student audience spurs the lectures engagement like the audience does to an actor in a theatre play, in the studio setting there maybe only the camera person, focused on her/his job. The challenge here is to imagine an attentive audience or present the lecture to the camera person. Possibly (a) listener(s) sitting in the recording room, could help simulating a “live” effect.

###### **d) Presentation slides**

a. As for lectures in general there are difficulties in mastering the use of slides (e.g. Powerpoint)

i. Slides (in my opinion) should contain very condensed and reduced content they are no substitute for a text book or other accompanying material.

ii. Slides should be carefully synchronized with the speech, e.g. by blending in bullet points in a synchronized fashion.

iii. Comparison slides – writing on the black/white-board: The disadvantage of writing to a board is that the lecturer faces their back to the audience which could cause a fall of attention, if excessively long text is written. Therefore a combination of projections and small written additions could be useful. A smart board would be helpful.

e) Interaction: a smartboard would have been ideal for a better balance between projecting prepared material and in-the-moment writing/calculating/development on the board. Livescribe in a Kahn Academy style would provide an alternative technology.

###### **f) Lighting:**

a. We encountered the problem of not strong enough light contrast to read the projection well and at the same time have enough light to see the teacher's face.

- b. Some projectors were flickering, which leads to artifacts in the video.
- c. We compensated the two latter issues by a montage of the video and the original (clear) slides.
- g) Noise:
  - a. Some projectors and people passing by outside created a considerable source of noise.
- h) Camera: it remains a question of debate, whether the lecturer should be seen or rather the voice could be heard (Kahn Academy style).
- i) Competition with video-taped teaching material on the internet. For any topic there is already numerous video-taped teaching material available on the web. So the question arises: Why producing your own videos? An important point in teaching is the consistency with terminology. The terminology used in the lecture should be consistent with the terminology used in the accompanying book. So this could pose a problem when using various online video teaching materials. Also you may want a course that is adapted in particular to the study context of these students. However, quality video material provided by others should be used, whenever reasonable, to save resources.
- j) IP issues. It was not entirely clear what material from the text book the teacher could use in videos and then publish as a video.
- k) A great side effect of working with video for us teachers was the video feedback, which taught us so much about our own teaching during the loop videotaping – watching – improving – retaking the tape

### 3. Experiences / thoughts / considerations regarding the in-class activities

- a. Collaborative solution finding: For one session the teacher tried the following model to solve exercises in class in a collaborative fashion across class: one student volunteer took over the role of a moderator that would pose problem related questions to the audience and lead the discussion. Another student volunteer took the role of the secretary that would just type code into the computer. All the rest were supposed to actively engage in contributing to the solution. What happened was that not so many students participated. And many students considered the general pace of progression too slow, and tried to move on and solve other assignments on their own without participating in the collaborative solution-finding in class.
- b. Apart from the class, we offered another session where TAs were available for helping with the homework. This was generally appreciated by the students and gave them the possibility to recap material relevant for the homework.
- c. In class, we followed an agenda of exercises. First the teacher explained an exercise in depth. Then the students were asked to solve it.
- d. During this time 3 TAs and the teacher constantly passed through the lines of students offering help and actively asking them where they were in the problem solving process. The teacher observed a couple of positive effects:
  - i. Students got tailored help adapted to exactly the point where they needed it

- ii. It gave the teacher very good feedback on where the students were, which problems occurred, so that the teacher could spontaneously insert short recapitulations of a relevant topic in front of class, if necessary.
- iii. Actively questioning the students individually often moved them out of a situation where they seemed to be stuck with a problem they even had a hard time to name. At the same time this dialogue did not expose them in front of the class.
- iv. The one-on-one interaction increased their engagement that can fall very low in a traditional lecture setting. The students could not drift away so easily or engage in social media or game activities on their computer, since they always had to be ready to communicate to a TA or the teacher.
- e. During the time they needed to solve the exercises, the teacher gave them little hints, usually every few minutes a new one, so they would not give up but be provided with as little help as possible so that they would have to still recall all their individual problem-solving potential.

### 4. Effect on student communication with the teacher? The communication seems to be improved.

### 5. Experiences / thoughts / considerations regarding the homework given to students

- a) In general, it seemed that the students did not do much preparatory homework.

### 6. Suggestions for the next year

- a. If the plan is to create more teaching videos at AAU one room could be modified for filming, in order to provide optimal conditions (lighting, low projector noise, setup for cameras).
- b. Possibly someone could sit in the recording and listen in order to create a more live setting.
- c. On a larger time perspective it could be attractive to create full online teaching material/online courses, for several reasons:
  - i. Promote AAU as an institution for good teaching.
  - ii. Facilitate cross-campus (AAU-CPH-ESB) coordination/synchronization. A large-scale teaching material may provide the bases for the course in all three campuses, with local tutoring, possibly reducing the necessary staff work load.
  - iii. Extend AAU activities in offering online courses/cooperation with other universities across Europe and the world.
- d. Alternative models could comprise the tools by live scribe where the writing on paper is recorded together with the voice of the lecturer, leading to a kind of Kahn Academy style.
- e. The importance of doing preparatory homework should be stressed more to the students, so that everyone has seen the requested videos and understand them. The students would need to be accustomed to this new didactic paradigm.
- f. Consider using existing videos on the internet. A possibility maybe to adapt an entire course including videos, exercises and locally play the role of a TA. As an alternative AAU could themselves offer such a package. Maybe these videos could be tailored by post-editing them.

g. It would be great to have more smart boards at AAU. That would greatly improve teaching, in particular the balance between prepared material and then interaction during class/in the video through in-the-moment calculation/writing.

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## 5. STUDENTS EVALUATION OF THE PREPARED MATERIAL AND PROCESS

There were two rounds of questionnaires and one session of in-deprh interviews provided by course-observers, and not the course teachers. The main findings are:

### Problematic issues:

- **Reaction to new:** Since it is a new approach, there is some kind of confusion and also reaction.
- **Structure:** It is not well structured and the material on Moodle is messy. The assignments should be linked to specific videos/reading material and be categorized according to their difficulty. A better reading guide should be provided explaining what is important and what is complementary.
- **Interaction in class:** Class discussion does not always work because people do not want to talk in front of such a large audience / are afraid of saying something wrong or admit that they don't understand. Also contributing is not obligatory like at high school. There are students who leave the classroom when it is exercise time and others who do not come to the class if they haven't studied the preparation material.
- **Non-diligent students/too much lecturing:** There are students who come to class unprepared so the teacher devotes time to explain what it had to be known. In reality, it looks more like a traditional lecture since not much time is devoted to assignments.
- **Assignments:** A large amount of hand-ins. More time is needed for submitting hand-ins in order to have more time to reflect on what is done in the classroom.
- **Videos:** Videos should not repeat what written in the book but instead provide explanations and

deepen into challenging topics. Avoid technical problems by uploading videos on YouTube.

### Strong positive points of this approach as mentioned by students during the interviews:

- Better support: You get more help/support than in traditional lectures.
- Solving exercises in class: Exercise time in the class with the teacher and teaching assistants is very helpful.
- Studying at own pace: You can pause/rewind while studying and also use the preparation material at any time for refreshing knowledge.
- Videos: It is faster watching the videos than reading the book.

## 6. CONCLUSION

As can be seen from the presented material, our first attempt to provide our own video-materials for a flipped blended course was a mixture of successes and failures. Although we have a vast knowledge of best practices in the field, due to lack of a software support our videos do not have the best combination of videos and captures, and organization of materials on Moodle platform was far from optimal. However, as this was just the first pilot year, and most polished courses now online required longer time to develop, we are still optimistic that the second edition of our course (due Spring 2016) will show significant improvement.

## LITERATURE

- [1] <http://ocw.mit.edu/about/our-history/>, visited 09/2015
- [2] <https://en.wikipedia.org/wiki/EdX>, visited 09/2015
- [3] <https://www.coursera.org/about/>, visited 09/2015
- [4] <https://en.wikipedia.org/wiki/Coursera>, visited 09/15
- [5] <https://www.khanacademy.org/about> visited 09/2015
- [6] <http://openeducationeuropa.eu/>, visited 09/2015
- [7] <http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/>, visited 09/2015
- [8] [https://courses.edx.org/courses/MITx/7.00x\\_2/2T2014/courseware/Week\\_2/Global/Biochemistry\\_2/](https://courses.edx.org/courses/MITx/7.00x_2/2T2014/courseware/Week_2/Global/Biochemistry_2/), visited 09/2015
- [9] <https://www.coursera.org/learn/learning-how-to-learn/home/welcome>, visited 09/2015
- [10] <https://moodle.org/>
- [11] F. Jørgensen and L. Busk Kofoed, "Integrating the development of continuous improvement and innovation capabilities into engineering education," *European Journal of Engineering Education*, vol. 32, pp. 181-191, 2007.
- [12] S. Barge, "Principles of Problem and project Based Learning, The Aalborg PBL Model, [http://www.aau.dk/digitalAssets/62/62747\\_pbl\\_aalborg\\_modellen.pdf](http://www.aau.dk/digitalAssets/62/62747_pbl_aalborg_modellen.pdf)," 2010.
- [13] E. Triantafyllou and O. Timcenko, "Developing digital technologies for undergraduate university



- mathematics: Challenges, issues and perspectives," in *21st International Conference on Computers in Education (ICCE 2013)*, Bali, Indonesia, 2013, pp. 971-976.
- [14] R. Kay and I. Kletschin, "Evaluating the use of problem-based video podcasts to teach mathematics in higher education," *Comput. Educ.*, vol. 59, pp. 619-627, 9, 2012.
- [15] B. Love, A. Hodge, N. Grandgenett and A. W. Swift, "Student learning and perceptions in a flipped linear algebra course," *International Journal of Mathematical Education in Science and Technology*, vol. 45, pp. 317-324, 04/03; 2014/04, 2014.
- [16] J. Strayer, "How learning in an inverted classroom influences cooperation, innovation and task orientation," *Learning Environments Research*, vol. 15, pp. 171-193, 07/01, 2012.
- [17] L. Nielsen, "Five reasons I'm not flipping over the flipped classroom," *Technology & Learning*, vol. 32, pp. 10-46, 2012.
- [18] J. J. Kellinger, "The flipside: Concerns about the "New literacies" paths educators might take," in *The Educational Forum*, 2012, pp. 524-536.
- [19] Y. Chiang and H. Wang, "Effects of the In-flipped Classroom on the Learning Environment of Database Engineering," *International Journal of Engineering Education*, vol. 31, pp. 454-460, 2015.
- [20] H. Y. L. Chen and N. S. Chen, "Design and evaluation of a flipped course adopting the holistic flipped classroom approach," in *Advanced Learning Technologies (ICALT)*, 2014 IEEE 14th International Conference On, 2014, pp. 627-631.
- [21] L. Abeysekera and P. Dawson, "Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research," *Higher Education Research & Development*, vol. 34, pp. 1-14, 01/02; 2015/04, 2015.
- [22] J. O'Flaherty and C. Phillips, "The use of flipped classrooms in higher education: A scoping review," *The Internet and Higher Education*, vol. 25, pp. 85-95, 4, 2015.
- [23] L. Coch and J. R. French Jr, "Overcoming resistance to change." *Human Relations*, 1948.
- [24] A. Kolmos and L. B. Kofoed, "Development of process competencies by reflection, experimentation and creativity," in *International Conference on Teaching and Learning in Higher Education: New Trends and Innovations*, 2003, .
- [25]
- [26]